

SUMMARY OF THE INVENTION

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Accordingly, it is an object of this invention to provide a plasma film-forming apparatus and a cleaning method wherein the dissipation of the radicals to be introduced into the film-forming chamber can be prevented.

Another object of this invention is to provide a plasma film-forming apparatus and a cleaning method wherein the radicals of the cleaning gas produced outside the film-forming chamber, can be effectively used for cleaning the film-forming chamber.

In accordance with one aspect of the invention, a plasma film-forming apparatus is provided which includes a film-forming chamber in which a substrate is arranged, a film-forming gas introducing pipe is connected to a supply source of a film-forming gas at its first end, a shower plate having numerous holes through which a second end of said film-forming gas introducing pipe communicates with said film-forming chamber, film-gas exciting means for exciting film-forming gas introduced through said shower plate into said film-forming chamber, to form a film on the surface of said substrate with a chemical reaction, radicals-producing means which excites said cleaning gas and produces radicals, and cleaning-gas introducing means which introduces said cleaning gas containing said radicals into said film-forming chamber, and the improvement resides in said cleaning-gas introducing means communicating directly with said film-forming chamber.

In accordance with another aspect of the invention, a cleaning method for a plasma film-forming apparatus is provided which, in the film-forming operation, introduces a film-forming gas through a shower plate having numerous holes into a film-forming chamber, excites the introduced gas and forms a film, with a chemical reaction, on a surface of substrate arranged in said film-forming chamber, and in the cleaning operation, introduces a cleaning-gas

containing radicals produced by exciting of said cleaning-gas into said film-forming chamber and cleans said film-forming chamber by chemical reaction of said radicals and removes materials to be cleaned, and the improvement resides in said cleaning gas containing said radicals being introduced directly into said film-forming chamber.

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1. (Amended) In a plasma film-forming apparatus which includes a film-forming chamber in which a substrate is arranged, a film-forming gas introducing pipe connected to a supply source of a film-forming gas at a first end thereof, a shower plate having numerous holes through which a second end of said film-forming gas introducing pipe communicates with said film-forming chamber, film-gas exciting means for exciting film-forming gas introduced through said shower plate into said film-forming chamber to form a film on the surface of said substrate with a chemical reaction, radicals-producing means which excites a cleaning gas and produces radicals, and cleaning-gas introducing means for introducing said cleaning gas containing said free radicals into said film-forming chamber, the improvement comprising said cleaning-gas introducing means communicating directly with said film-forming chamber.

2. (Amended) A plasma film-forming apparatus according to claim 1, in which said cleaning-gas introducing means comprises a first cleaning-gas introducing pipe, communicating with said film-forming chamber from one of two opposite walls of said chamber, and a second cleaning-gas introducing pipe communicating with said film-forming chamber from the other of the opposite walls, and said first and second cleaning-gas introducing pipes are offset from the centers of said walls in opposite directions.

3. (Amended) A plasma film-forming apparatus according to claim 1 or 2 in which the inside surface of said cleaning-gas introducing means is coated with polytetra fluoro ethylene.

4. (Amended) In a cleaning method for a plasma film-forming apparatus which, in a film-forming operation, introduces a film-forming gas through a shower plate having numerous holes into a film-forming chamber, excites the introduced gas and forms a film with the chemical reaction on a surface of a substrate arranged in said film-forming chamber, and in a cleaning operation, introduces a cleaning-gas containing radicals produced by exciting said cleaning-gas into said film-forming chamber and cleans said film-forming chamber by chemical reaction of